Assignment 2

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Download the python codes from

https://github.com/tanayyadav28/Assignments/blob/main/Assignment%202/code/assignment2.py

and latex-tikz codes from

https://github.com/tanayyadav28/Assignments/blob/main/Assignment%202/assignment2.tex

1 Problem

(Prob 5.21) Savita and Hamida are friends. What is the probability that both will have
(i) different birthdays?
(ii) the same birthday?
(ignoring a leap year).

2 Solution

Let the Bernoulli random variable $X = \{0, 1\}$ denote the outcome of the given experiment.
$X = 0$ denotes the outcome that Savita and Hamida have their birthdays on a *same day* of the year.
$X = 1$ denotes the outcome that Savita and Hamida have their birthdays on *different days* of the year.

$$\Pr(X = 0) = \frac{1}{365} \tag{2.0.1}$$

as there is only one way to have both of their birthdays on a same day of a year.

$$\Pr(X = 0) + \Pr(X = 1) = 1 \tag{2.0.2}$$

$$\Pr(X = 1) = 1 - \Pr(X = 0) \tag{2.0.3}$$

Putting the value of $\Pr(X = 0)$ from (2.0.1) in (2.0.3)

$$\therefore \Pr(X = 1) = 1 - \frac{1}{365} \tag{2.0.4}$$

$$\therefore \Pr(X = 1) = \frac{364}{365} \tag{2.0.5}$$

Now, from (2.0.1) and (2.0.5),

$$\Pr(X = 0) = \frac{1}{365} \tag{2.0.6}$$

$$\therefore \Pr(X = 0) = 0.00273972 \tag{2.0.7}$$

$$\Pr(X = 1) = \frac{364}{365} \tag{2.0.8}$$

$$\therefore \Pr(X = 1) = 0.99726027 \tag{2.0.9}$$

Hence, from (2.0.7) and (2.0.9),
the probability that Savita and Hamida have a birthday on same day ($\Pr(X = 0)$) is 0.00273972,
and that they have their birthdays on different days of the year ($\Pr(X = 1)$) is 0.99726027.